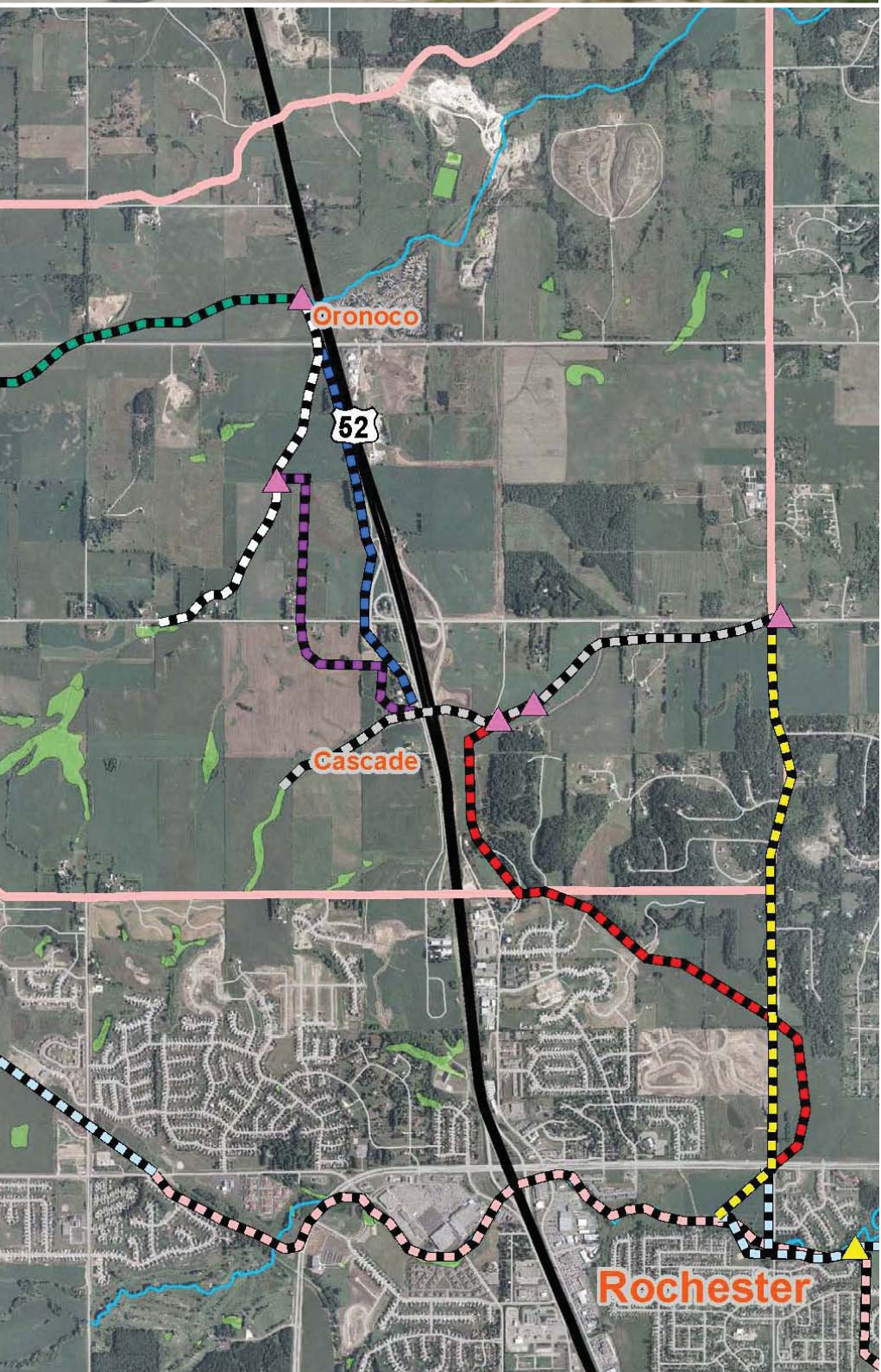




City of Rochester

Executive Summary



Northwest Territory Sanitary Sewer System Feasibility Analysis

July 2013



Executive Summary

Introduction

The purpose of this “Northwest Territory Sanitary Sewer System Feasibility Analysis” is to develop a cost-effective implementation strategy for future sanitary sewer service to the 7,309-acre Northwest Territory (NWT) study area. The feasibility study considers near-term, medium-term, and long-term sewer service needs, construction alternatives, and funding strategies.

The Northwest Territory of the City of Rochester is generally bounded by 65th Street NW on the south, 100th Street NW on the north, 18th Avenue NW on the east, and 75th Avenue NW on the west (Figure ES-1). The current study area has been revised and expanded from the original study, completed by the City of Rochester in 2005, to more fully consider the potential future long-term development of all the areas that contribute to the NWT study area sewershed. The majority of the area in the NWT is currently agricultural land. The NWT is anticipated to receive considerable future residential and commercial development as the City of Rochester continues to grow. The anticipated ultimate population in the study area is estimated to be 45,000 persons, with approximately 35,000 located within the Urban Service Area boundaries.

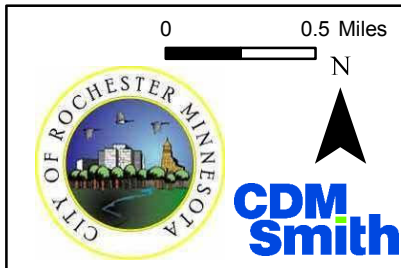
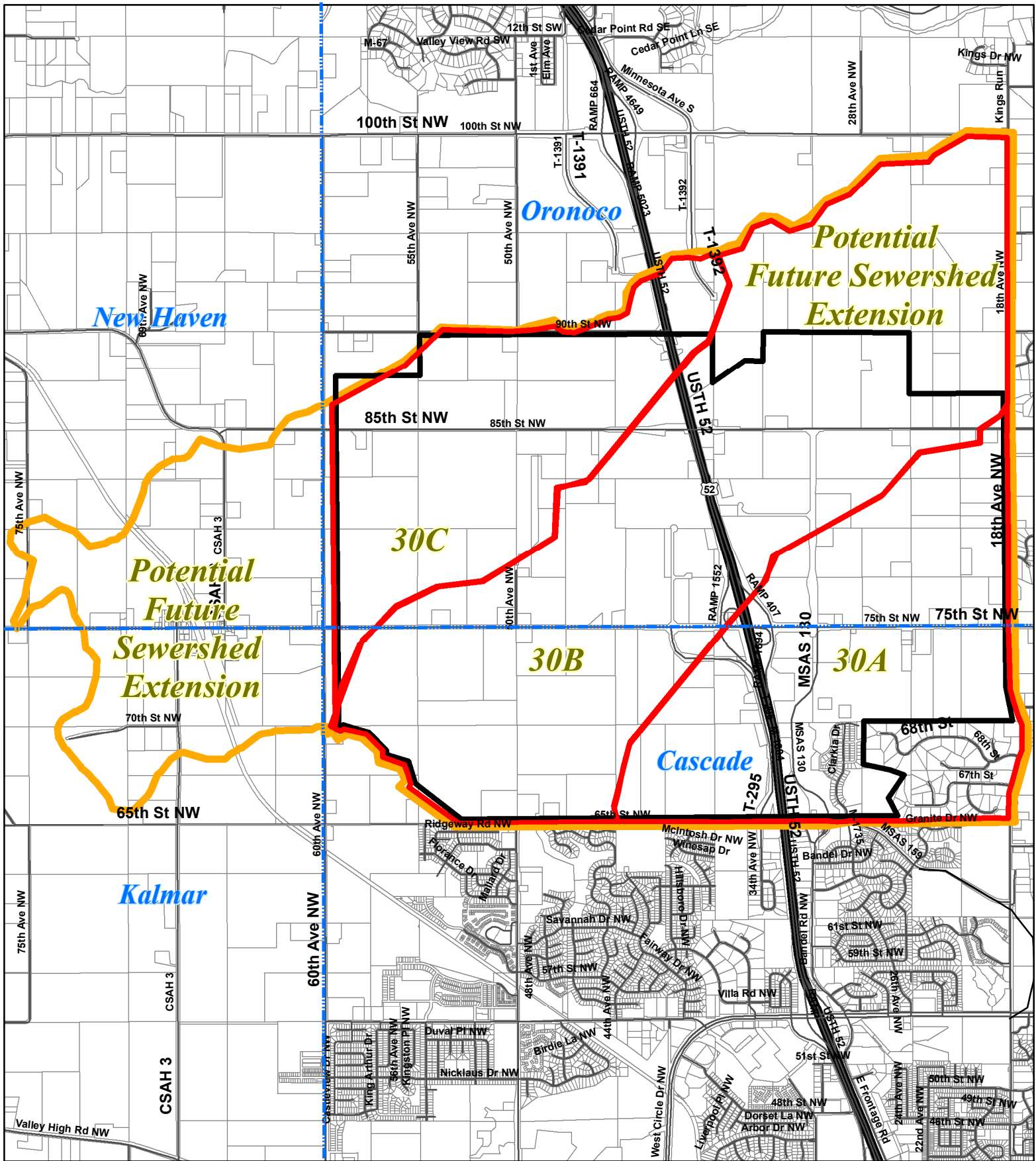
The study defined three sewer service areas, 30A, 30B, and 30C, for the NWT area and proposed conceptual alignments (including alternatives) for trunk sewer extension to serve the three sewer service areas. This study has revised the service areas to follow existing topography in more detail. In addition to study areas 30A, 30B, and 30C, the NWT study area also includes the Village of Douglas, which was added to the study for properly sizing downstream pipes only. As a result, the NWT service area was increased from 5,005 gross acres in the 2005 study to 7,309 gross acres to accommodate additional service area west of 60th Avenue NW and north of 90th Street NW.

Critical Success Factors

Critical success factors for the City of Rochester NWT feasibility study include the following:

- Demonstrating financial stewardship by optimizing capital expenditures through development of a cost-effective sewer implementation phasing and funding strategy.
- Demonstrating social responsibility and environmental stewardship in evaluation of alternative sewer projects.
- Developing accurate intermediate and ultimate system flows so that the right size infrastructure is built at the right time.
- Developing trunkline sewer alternative alignments that optimize serviceability and minimizes project risks.
- Identifying, managing, and mitigating project geotechnical and tunnel risks.

Developing life-cycle costs to determine the cost-effectiveness of alternative sewer alignments.



- Service Area 30A, 30B, 30C
- Urban Service Area
- Northwest Territory Sewershed
- Road
- Parcel
- Townships

**Figure ES-1
Northwest Territory
Study Area**

NW Territory Sanitary Sewer
System Feasibility Analysis
August 1, 2013

Flow Projections

Future NWT Land Use

The Olmsted County 2040 Long Range Transportation Plan provided basic planning and future land use information for the area south of 75th Street NW. Future land use data for the area north of 75th Street NW was developed by working with the Rochester-Olmsted Council of Governments (ROCOG) Planning Department staff. Future land use within the study area is projected to be a mix of low- to high-density residential, commercial, and industrial uses (Figure ES-2). The land use type was used to determine projected wastewater flow rates across the NWT.

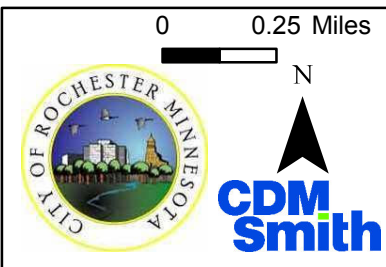
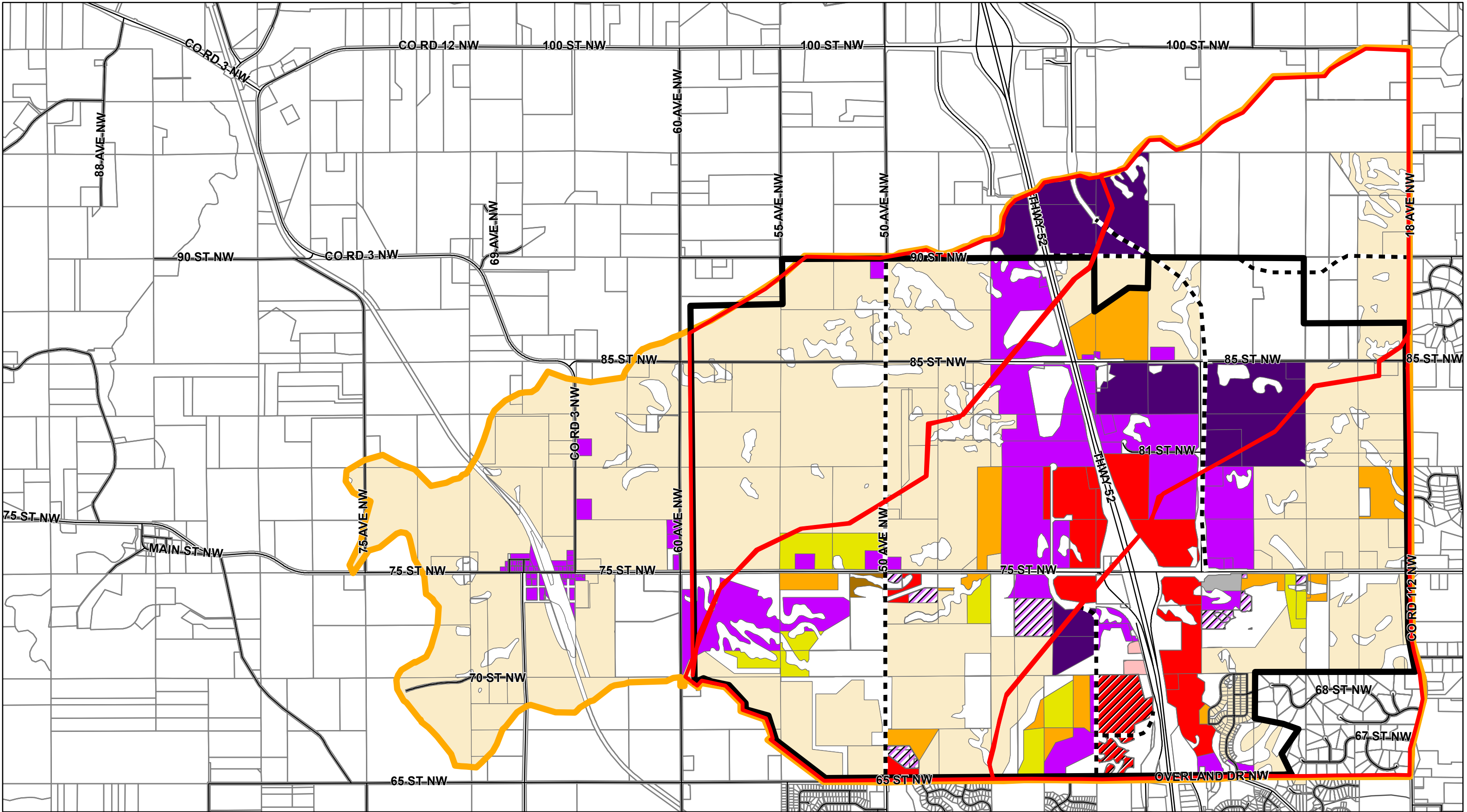
Areal Loading Rates and Projected Flows

Areal loading rates were developed for each land use category as shown in Table ES-1. Areal loading rates are based on the corresponding number of equivalent households per acre for each land use category multiplied by the 175 gpd water generation rate per household. Table ES-1 also summarizes average flow volume contribution based on each land use category within the NWT. Average flow volume contribution for each land use category equals the total developable area for that land use category multiplied by the corresponding average areal loading rate. The total average flow volume contribution for the NWT service area is the sum of average flows generated from each land use category. Standard wastewater peaking factors were then applied to estimate the peak flow for each phase of development.

Table ES-1 Average Flow Generation for the NWT Service Area

Land Use	Equivalent Households per Acre	Units/Average Areal Loading (gpad)	Total Developable Area (ac)	Average Flow (mgd)
Residential – Single Family ¹	7.0	1,230	2,126	2.61
Residential – Multi-Family	10.0	1,750	190	0.33
Residential – Townhouse	6.0	1,050	126	0.13
Residential – Mixed Use	8.0	1,400	6	0.01
Commercial – General	5.0	880	619	0.54
Commercial – High Intensity	12.0	2,100	9	0.02
Commercial – Hotel	15.0	2,630	6	0.02
Commercial – Office	5.0	880	51	0.04
Commercial – Shopping Center	5.0	880	198	0.17
Commercial – Big Box	4.0	700	55	0.04
Industrial	8.0	1,400	380	0.53
Total			3,767	4.46

¹ For the single family land use category, a density of 7.0 units per net developable acre was used. The net developable area was calculated to be 60% of the total area with 40% reserved for undevelopable area and green space. This category will have a significantly greater level of undevelopable green space than other categories.



<ul style="list-style-type: none"> Future Major Road Urban Service Area Service Area 30A, 30B, 30C 	<ul style="list-style-type: none"> Northwest Territory Sewershed Commercial - General Commercial - High Intensity Commercial - Hotel 	<ul style="list-style-type: none"> Commercial - Office Commercial - Shopping Center Commercial - Big Box Industrial 	<ul style="list-style-type: none"> ROW/Undevelopable Residential - Mixed Use Residential - Multi-Family Residential - Single Family 	<ul style="list-style-type: none"> Residential - Townhouse Parcel
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Figure ES-2
Future Land Use Estimated
for Sewer Flow Calculation

*NW Territory Sanitary Sewer
System Feasibility Analysis
June 18, 2013*

Phasing of Development

It is expected that the initial growth in the NWT Urban Service Area will occur south of 75th Street NW, between 50th Avenue and 18th Avenue, with orderly development proceeding north and west thereafter. Initial growth in each phase will be centered along both sides of Highway 52, expanding east and west approximately one-half mile in both directions. The phasing of development is anticipated to follow this order:

- Phase I: 30A service area.
- Phase II: Area south of 75th Street NW in service area 30B.
- Phase III: Area north of 75th Street NW in service area 30B.
- Late State of Phase III: Service area 30C and Douglas.

Table ES-2 provides the gross, developable, and undevelopable acreages for each phase of development within the Urban Service Area.

Table ES-2 Urban Service Area Developable Acreage⁽¹⁾

Area	Gross Acreage (ac)	Developable Acreage (ac)	Undevelopable Acreage (ac)	% Developable	Sub-sewershed
Urban Service Area – Phase I Improvements	1,500	796	704	53%	5A1, 5A2, 5A5
Urban Service Area – Phase II Improvements	1,250	769	481	62%	5B1, 5B2, 5B4 serving area between 75 th Street and 2,700 ft north of 75 th Street
Urban Service Area – Phase III Improvements	2,255	1,088	1,167	48%	5B4, 5B7, 5C1
Total	5,005	2,653	2,352	53%	

⁽¹⁾ Urban service area boundary excludes future sewershed extension area west of 60th Avenue and north of 90th Street.

Alternatives Development Criteria

Alternatives for NWT trunkline sewers were developed based on the following criteria:

- Establish the proposed alternative of the sub-trunkline sewers necessary to enable development of the entire NWT.
- Routing of alternatives to avoid/minimize impact on selected/sensitive areas; MnDOT rights-of-way, cemetery lands, landfill/dump sites, etc.
- Locate the proposed alternative outside of the MnDOT right-of-way.
- Accommodate the phasing of development across the NWT.

Refer to Figures 4-7 through 4-18 in the Final Report for a detailed map of each alternative.

Composite Alternatives

The different Phase I, Phase II, and Phase III trunk sewer improvement options (Table ES-3) utilized a variety of combinations of lift stations, force mains, and gravity tunnels to address the intermediate and ultimate development needs for the NWT. Viable improvement options were integrated into composite alternatives that address the needs of the NWT through ultimate development. Improvement options that were incompatible with each other were screened out from further

consideration in the development of composite alternatives. The final list of composite alternatives provide a complete set of system improvements and the relative timing of the improvements to meet the ultimate growth conditions forecasted for the NWT service area.

Each of the Phase I, Phase II, and Phase III trunk sewer improvement options was evaluated independently and in conjunction with the 18 composite alternatives. Each component or composite alternative was evaluated for capital costs, life cycle costs, and nonmonetary considerations. A scoring/ranking system was applied to evaluate each alternative and an alternative was recommended based on the highest ranking. Capital costs for the 18 composite alternatives were estimated to range from \$40.6 million to \$111.8 million and the life cycle costs for the alternatives ranged from \$43.6 million to \$78.3 million. The Phase I, Phase II, and Phase III trunk sewer improvement options and the composite alternatives were then evaluated using a Triple Bottom Line approach.

Triple Bottom Line Evaluation of Alternatives

A Multi-Criteria Assessment approach termed Triple Bottom Line (TBL) was used to evaluate Phase I, Phase II, and Phase III trunk sewer improvement options and the 18 composite alternatives. The Triple Bottom Line approach involves assessing, weighting, scoring, and ranking each alternative according to the following criteria:

- Economic criteria are defined as benefits and cost impacts associated with the project, and are typically represented by lifecycle costs.
- Environmental criteria are defined as benefits or impacts to the environment that would result from implementing a proposed action. These include wetlands, and other unique natural features that may be impacted as a result of the project.
- Social criteria are defined as all benefits and impacts to private property, property owners, and the general public. Social criteria for the alternatives evaluation include neighborhood aesthetics, odors, public acceptance, construction impacts, land acquisition, and reliability.

Result and Recommendation

The average scoring/ranking of the 18 composite alternatives was presented in Table ES-3. The scoring and ranking are finalized based on input from CDM Smith and the City of Rochester. Composite alternative 10 was selected as a result of the evaluation of alternatives, and is shown in Figure ES-3.

Table ES-3 presents a summary of the evaluation of the composite alternatives and individual improvement components. The 18 evaluated alternatives are shown in the table with the 14 individual project components. One project component is required from each of the three phases (shown in orange, blue, and grey in the table) to form a composite alternative. Not all improvement options are compatible with each other. The composite alternatives are ranked by mathematically combining the individual scores of each individual component of the alternative.

Capital, O&M, and present worth costs are also shown for each alternative. It is important to note that the overall costs presented in Table ES-3 reflect credits and/or deductions for redundant uses of piping and expansion of lift stations when required by subsequent phasing.

Table ES-3 Evaluation of Composite Alternatives

ALTERNATIVE	Improvements														Average Score	Overall Rank		LIFE CYCLE COST (LCC, \$)			
	Year = 0		Year = 5						Year = 30									2011 Capital Cost	Annual Equivalent Cost of O&M	Present Worth Capital	Present Worth O&M
	1B – 5A4 LS @ Prairie Crossing (Permanent LS, 10.7 mgd, 58 ft deep)	1D– Tunnel from 18 th Ave to the Stub Out	2A – 5B3 LS @ 75 th St (Interim LS, 3 mgd, 22 ft deep)	2B – 5B3 LS @ 75 th St (Interim LS, 3 mgd, 49 ft deep)	2C1 – 5B3 LS @ 2,700ft North of 75 th St (Interim LS, 3 mgd, 22 ft deep)	2C2 – 5B3 LS @ 2,700ft North of 75 th St (Permanent LS, 3 mgd, 49 ft deep)	2D– Tunnel from 5B3 LS Location @ 75 th St to 5A5 Sewer	2F- Tunnel from 5B3 LS Location @ 2,700 ft North of 75 th St to 5A5 Sewer	3A – 5B5 LS @ 900 ft North of 85 th St (Permanent LS, 9 mgd, 28 ft deep)	3B – 5B5 LS @ 900 ft South of 85 th St (Permanent LS, 9 mgd, 39 ft deep)	3C – 5B5 LS@2,700 ft North of 75 th St (Permanent LS, 9 mgd, 49 ft deep)	3E – Tunnel from 5B5 LS Location @ 2,700 ft North of 75 th St to 5B3 Tunnel	3F- Tunnel from 5B5 LS Location @ 2,700 ft North of 75 th St to 5A5 Sewer	3G – 5B7 and 5C1 Trunk Sewers Only							
1	1		2						2						1.67	3	41,000,000	567,000	31,437,000	12,175,000	43,612,000
2	1		2							3					2.00	5	42,400,000	559,000	31,981,000	12,013,000	43,994,000
3	1		2										5		2.67	9	65,600,000	430,000	38,394,000	9,218,000	47,612,000
4	1		2								1				1.33	2	43,100,000	552,000	32,298,000	11,842,000	44,140,000
5	1			4					2						2.33	7	42,600,000	584,000	32,509,000	12,542,000	45,051,000
6	1			4						3					2.67	9	44,000,000	576,000	33,053,000	12,380,000	45,433,000
7	1			4									5		3.33	14	67,200,000	447,000	39,466,000	9,586,000	49,052,000
8	1			4							1				2.00	5	44,700,000	569,000	33,370,000	12,209,000	45,579,000
9	1				3								5		3.00	12	66,200,000	463,000	39,052,000	9,938,000	48,990,000
10	1					1								1	1.00	1	40,565,000	573,000	35,175,000	12,304,000	47,479,000
11	1						6		2						3.00	12	58,800,000	485,000	43,869,000	10,424,000	54,294,000
12	1						6			3					3.33	14	60,200,000	477,000	44,409,000	10,262,000	54,671,000
13	1						6				1				2.67	9	60,700,000	470,000	44,620,000	10,091,000	54,711,000
14	1						6					4			3.67	17	64,200,000	348,000	44,332,000	7,468,000	51,800,000
15	1							5						1	2.33	7	62,400,000	348,000	47,004,000	7,468,000	54,472,000
16	1				3						1				1.67	3	42,400,000	585,000	33,384,000	12,561,000	45,945,000
17		4						5						1	3.33	14	110,000,000	32,000	77,631,000	679,000	78,309,000
18		4					6					4			4.67	18	111,800,000	32,000	74,959,000	679,000	75,638,000
TOTAL CONST. COST, \$	16,400,000	64,000,000	6,700,000	8,300,000	7,900,000	11,500,000	18,800,000	25,400,000	17,900,000	19,300,000	20,000,000	37,900,000	42,500,000	11,600,000							
LCC -Total, \$	25,890,000	49,728,000	7,177,000	8,616,000	8,793,000	14,302,000	13,557,000	18,268,000	10,545,000	10,927,000	11,073,000	12,966,000	14,545,000	3,967,000							

* Based on present worth total

Phase I Improvement Recommendation

Option 1B – 5A4 Lift Station @ NW of Prairie Crossing has the highest score/ranking among the options and is the recommended option for Phase I improvements. Rationale for selecting Option 1B includes:

- The expected capital cost, life-cycle cost, and total construction cost per acre served for Option 1B is lower than the other five options.
- The parcels of land at NW of Prairie Crossing where the lift station would be sited are within the City of Rochester.
- The lift station site NW of Prairie Crossing has the least wetlands, stormwater ponds, and environmental impact since the site is not in or adjacent to the proposed stormwater pond sites.

The lift station will be 58 feet deep. At this depth, the lift station is able to receive flow from Phase II and Phase III improvements. The lift station will be dry well/split wet well configuration. The split wet well with 2 to 3 compartments allows the flexibility for the lift station to handle initial low flow from immediate development needs and higher flow from ultimate development needs. The pumps in the 5A4 dry well will be initially sized for 3 mgd to handle flow from service area 30A, but will be updated to handle more flow as development from service areas 30B and 30C occurs.

Phase II Improvement Recommendation

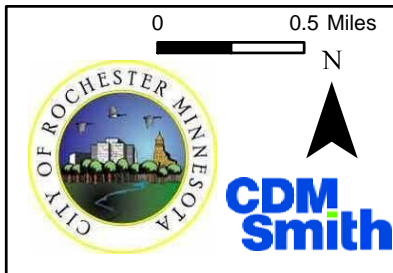
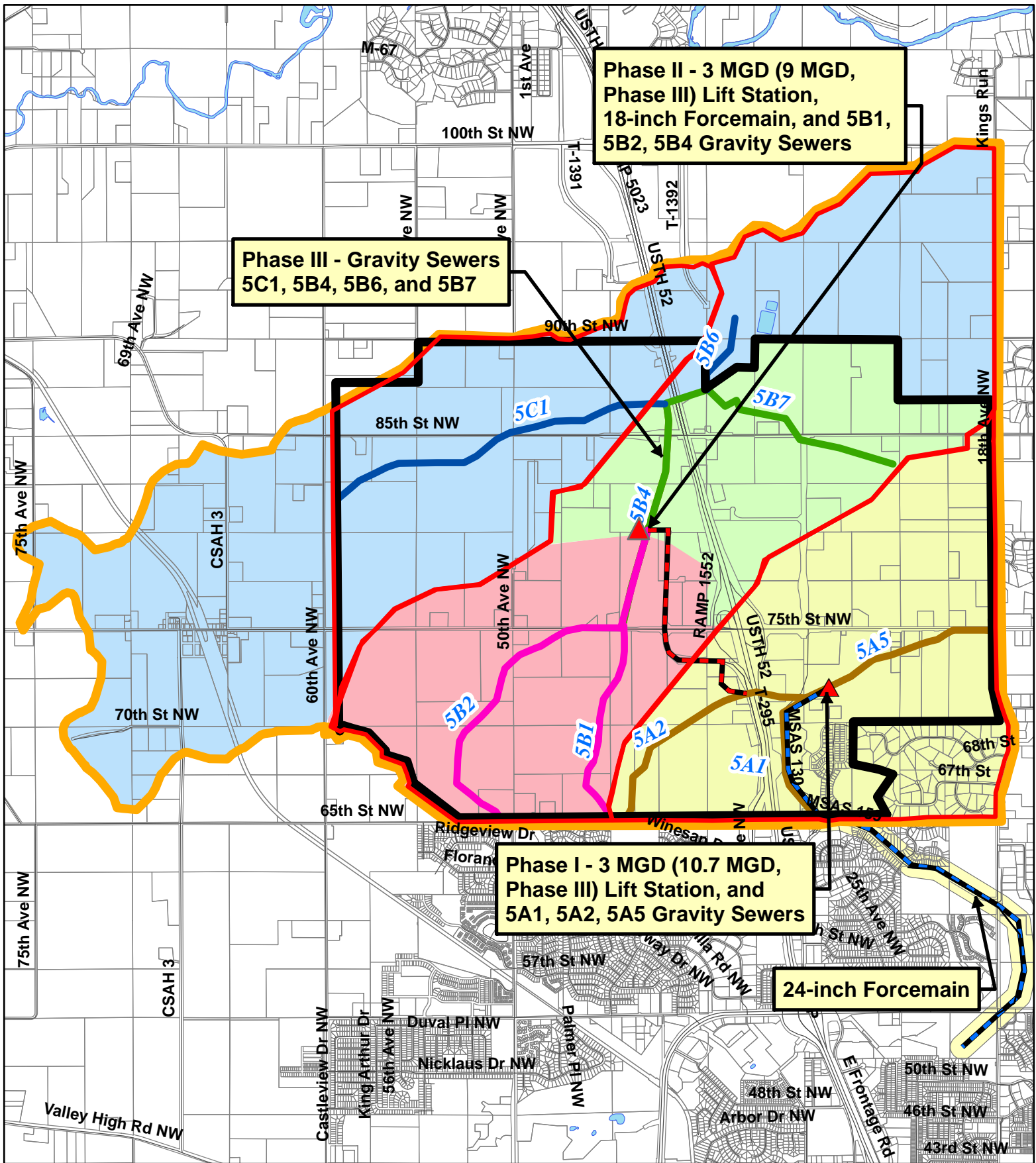
Option 2C2 – 5B3 Lift Station @ 2,700 Feet North of 75th Street NW has the highest scoring/ranking among the options and is recommended for Phase II improvements. Rationale for selecting Option 2C2 includes:

- Option 2C2 has the largest acres served among the lift station options.
- Option 2C2 has lower capital costs and life-cycle costs than the tunnel options.
- The expected total construction cost per acre served for Option 2C2 is lower than the other Phase II options.

Option 2C2 involves construction of a permanent lift station at a site 2,700 feet north of 75th Street NW. The lift station will be 49 feet deep. At this depth, the lift station is able to receive flow from Phase II and Phase III improvements. The lift station will be dry well/split wet well configuration. The split wet well with 2 to 3 compartments allows the flexibility for the lift station to handle initial low flow from immediate development needs and higher flow from ultimate development needs. The pumps in the dry well will be initially sized for 3 mgd flow for intermediate development, but can be upgraded to handle more flow as the need arises. Option 2C2 provides greater ability to accommodate development flexibility than the other lift station option.

Phase III Improvement Recommendation

Option 3C – 5B5 Lift Station @ 2,700 Feet North of 75th Street NW has the highest score/ranking among the options and is recommended for Phase III improvements. The option is essentially the same as Option 2C2 for Phase II improvements except that the pumps need to handle 9 mgd of flow. It is recommended that the 5B3/5B5 lift station will be constructed as a 3 mgd, 49 feet deep dry well/wet well station at a site 2,700 feet north of 75th Street NW in Phase II, but upgrade the pumps for 9 mgd of flow in Phase III.



- Northwest Territory Sewershed
- Phase I Forcemain
- Phase II Forcemain
- Sub-Trunkline Gravity Sewer Phase 1
- Sub-Trunkline Gravity Sewer Phase 2
- Sub-Trunkline Gravity Sewer Phase 3
- Sub-Trunkline Gravity Sewer Later Stage of Phase 3
- Service Area 30A, 30B, 30C
- Urban Service Area
- Road
- Parcel
- Later Stage Phase 3
- Phase 1
- Phase 2
- Phase 3

**Figure ES-3
Recommended Alternative**

NW Territory Sanitary Sewer
System Feasibility Analysis
August 1, 2013

Composite Alternative

Alternative 10, which combines Option 1B – 5A4 Lift Station @ NW of Prairie Crossing for Phase I improvements, Option 2C2 – 5B3 Lift Station @ 2,700 Feet North of 75th Street NW for Phase II improvements, and Option 3C – 5B5 Lift Station @ 2,700 Feet North of 75th Street NW, is the recommended alternative (Table ES-3). Alternative 10 involves construction of the permanent 5A4 lift station at NW of Prairie Crossing in Phase I and construction of the permanent 5B3/5B5 lift station at a site 2,700 feet north of 75th Street NW in Phase II. Table ES-4 identifies the key components and corresponding phasing of components for the recommended alternative.

Table ES-4 Improvement Projects for Alternative 10

Phase I Improvements	Phase II Improvements	Phase III Improvements
Construction of 5A1, 5A2, and 5A5 sub-trunkline sewers, including 48-inch gravity sewer that connects to 5A4 lift station	Construction of 5B1, 5B2, and 5B4 sub-trunkline sewer	Construction of 5C1, 5B6, 5B7 sub-trunkline sewer, and 5B8
Construction of 5A4 lift station at NW of Prairie Crossing (58 feet deep; dry pit/split wet well configuration; pumps sized for 3 mgd flow)	Construction of 5B3/5B5 lift station at 2,700 feet north of 75 th Street NW (49 feet deep; dry pit/split wet well configuration; pumps sized for 3 mgd flow) Upgrade the pumps of 5A4 lift station to handle 5.5 mgd flow (i.e., flow from Phase I – intermediate and Phase II improvements)	Upgrade the pumps of 5A4 lift station and 5B3/5B5 lift station to handle 10.7 mgd (5A4 lift station) and 9 mgd (5B3/5B5 lift station) ultimate flows, respectively
Construction of 13,050 feet of 24-inch forcemain from NW of Prairie Crossing to 55 th Street NW and 18 th Avenue NW	Construction of 6,660 feet of 18-inch forcemain from 5B3/5B5 lift station to the 48-inch gravity sewer trunkline located immediately west of Hwy 52 that connects to the 5A4 lift station	

Cost Recovery

An estimate of associated cost recovery is included in Table ES-5. Properties located within the Phase I improvement area would have a sewer availability charge (SAC) fee of \$15,249 per developable acre; this includes the cost of providing sewer service to the parcels within the NWT by dividing the anticipated construction cost for Phase I improvements attributable to Phase I by the total number of developable acres in Phase I, and also includes a pro-rated cost to upgrade downstream facilities to the required capacity to support the increased sewer flows generated by the Phase I improvements.

Properties within the Phase II and Phase III improvement areas would have a SAC fee of \$16,045 per developable acre; by dividing the anticipated construction cost for Phase II and Phase III improvements by the total number of developable acres in Phase II and Phase III, and also includes the pro-rated cost to upgrade downstream facilities, as well as an additional surcharge cost to upsize facilities in Phase I that are needed to accommodate the greater capacity required to accommodate the additional flows in Phase I that are generated by the Phase II and Phase III service areas.

Table ES-5 Anticipated Cost Recovery for the Recommended Alternative

	Area (acres)	% of Total Area	Cost Attributable to Phase I	Cost Attributable to Phase II and Phase III	Total Cost
Phase I	976	34.50%	\$13,097,666	\$3,299,641	\$16,397,307
Phase II	1,857	65.50%		\$11,500,000	\$11,500,000
Phase III				\$11,600,000	\$11,600,000
SAC Rate Phase I (per acre) ¹			\$13,420	\$1,777	
SAC Rate Phase II and III (per acre)				\$12,439	
Downstream Capacity Improvements (per acre)			\$1,829	\$1,829	
Total Combined SAC Rate (per acre)			\$15,249	\$16,045	

¹ The Phase I SAC rate was calculated including the acreage of the large lot subdivision located near 18th Ave NW and 65th St NW.

